EC-101 Intelligent Controller

User Manual V1.1

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Unit 1 Introduction

1.1 Brief Instruction

EC-101 intelligent controller is an intelligent and high-precision measuring and control instrument to display liquid level, temperature and pressure in digital. Equipped With level sensor, pressure sensor, temperature sensor and transducer it can make all ranges of measuring and control system for level, temperature and pressure.

The input of EC-101 intelligent controller may be T.C, RTD, 0-10mA or 4-20mA standard current and 0-5V or 1-5V standard voltage, and it can be changed freely.

There are four alarm outputs and each can be defined as upper limit alarm or lower limit alarm. The output can be standard current transform output of 0-10mA or 4-20mA and the sensor power supply output of 12VDC/50mA, 5VDC/50mA and 24VDC/50mA.

Features

- ◆Adopting the most advanced ATMEL single chip Microcomputer reduce the peripheral components and improve its reliability;
- ◆integrate universal input, several output methods in one controller;
- ◆Adopt multi advanced techniques, such as WATCHDOG circuit, software trap & instruction redundancy, power-off protection, digital filter and so on, field fault-tolerant ability is highly paid attention to; all these techniques make the controller has strong anti-interference capability;
- ◆Adopting modularized output interface, the function configuration is convenient and flexible;
- ◆Double four-bit LED digital display, it can display measured value and the 1st alarm value;
- ◆With pillar-light of 20 segments display measured value;

1.2 Model introduction

EC-101	□	□	□	□	□	□	□	introduction
Outline dimension（mm）	□							A：96×96 B：48×96 C：96×48 D：160×80 E：80×160 F：72×72 G：48×48
Main output		□						N：None J1：Relay output（3A normal open + normal close） J2：Relay output (0.8A normal open) J3：two channels of Relay output (0.8A normal open×2) T：Solid state relay triggering output (12V/40mA)
Output 1(AL1)			□					N：None J：Relay output（3A normal open） T：Solid state relay triggering output (12V/40mA)
Output 2(AL2)				□				N：None J：Relay output（3A normal open） T：Solid state relay triggering output (12V/40mA) V1：DC 12V/50mA sensor power supply V2：DC 24V/50mA sensor power supply V3：DC 5V/50mA sensor power supply V5： Voltage transform output 0-5V I：Current transform output (0-10mA 4-20mA)

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EC-101	□	□	□	□	□	□	□	introduction
Output 3(AL3)					□			N：None V1：DC 12V/50mA sensor power supply V2：DC 24V/50mA sensor power supply V3：DC 5V/50mA sensor power supply Voltage transform output 0-5V I：Current transform output (0-10mA 4-20mA) R: RS232 communication S: RS485 communication
Input mode						□		0：Thermocouple, RTD, 0-5V, 1-5V 1：Thermocouple, RTD, 0-10mA, 4-20mA

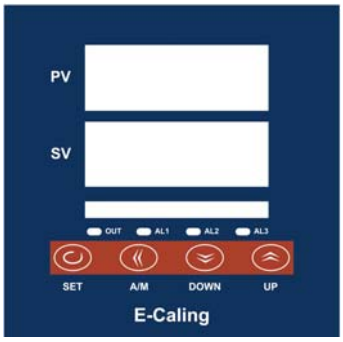
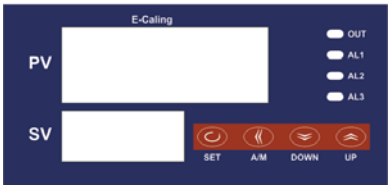
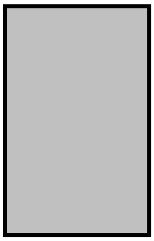
Remark：Note in the table "□" means，For example：

EC-101A JJJV1，its means below

EC-101 A J J J V 1

- A: means 96×96mm
- J: means Relay main output
- J: means Relay secondary output 1
- J :means Relay secondary output 2
- V: means Voltage secondary output 3
- 1: means Thermocouple 1 input

1.3 **Outline dimension and Install Hole size ：**

	Outline dimension code A	Outline dimension code B	Outline dimension code C
Panel size	**Panel size：** **96(W)×96(H)×(D)105mm** 	**Panel size：** **96(W)×48(H)×(D)105mm** 	**Panel size：** **48(W)×96(H)×(D)105mm**
Install Hole size	**Install Hole size ：** **92(W)×92(H),D＞105mm** 	**Install Hole size ：** **92(W)×45(H),D＞105mm** 	**Install Hole size ：** **45(W)×92(H),D＞105mm** 

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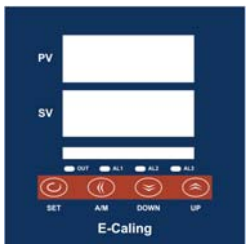
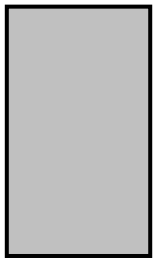
	Outline dimension code D	Outline dimension code E	Outline dimension code F
Panel size	**Panel size：** **160(W)×80(H)×(D)105mm** 	**Panel size：** **80(W)×160(H)×(D)105mm** 	**Panel size：** **72(W)×72(H)×(D)105mm** 
Install Hole size	**Install Hole size ：** **152(W)×76(H),D＞105mm** 	**Install Hole size ：** **76(W)×152(H),D＞105mm** 	**Install Hole size ：** **68(W)×68(H),D＞105mm**

	Outline dimension code G
Panel size	**Panel size：** **48(W)×48(H)×(D)105mm**
Install Hole size	**Install Hole size ：** **45(W)×45(H),D＞105mm**

1.4 Main specification

- ◆ Accuracy: ±0.2% F.S ±1digit
- ◆ Power supply: 85V-264V or DC24V
- ◆ Power consumption: < 4w
- ◆ Ambient temperature: -15-60℃
- ◆Ambient humidity: <85% RH
- ◆Input signal：（remark：Sensor error or over range: Sb）

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S.N.	Input model	Code	Input model	Measuring range	Code	Input model	Measuring range
1	Thermocouple	0	K	0--1300℃	4	E	-200--1000℃
		1	S	0--1700℃	5	J	0--800℃
		2	B	0--1800℃	6	Wre325	0--2300℃
		3	T	-200--400℃	7	N	0--1300℃
2	RTD	8	Pt100	-200--600℃	9	Cu50	-50--150℃
3	Standard current	14	DC 0-5V	-999-9999	15	DC 1-5V	-999-9999
4	Standard voltage	16	4-20mA	-999-9999	17	0 - 10mA	-999-9999

◆ Output Signal

S.N.	Output mode	Output 1	Output 2	Output 3
1	Relay on/off output	AC220V/3A	AC220V/1A	/
2	Current transform output	0-19mA	4-20mA	/
3	Sensor power supply	DC24V/50mA	DC12V/50mA	DC5V/50mA

◆ Cold-junction compensation error: ±1℃
◆ Resolution: 0.1℃
◆ Display mode: 2 x 4 bit LED digital display, pillar-light of 20 segments
◆The sampling period：0.5s
◆ Control mode: the four alarm can be set as upper limit alarm or lower limit alarm freely.

1.5 **Terminal Connection (please refer to the connection diagram on meter shell)：**

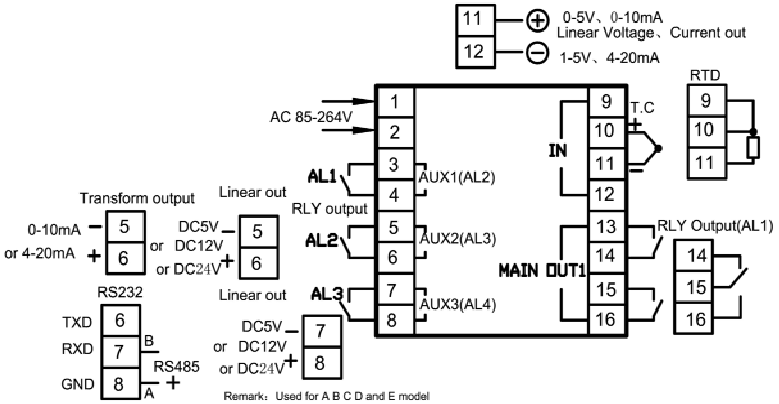
1) 96 X 96, 48 X 96(V), 80 X 96(V):

Note:

a) The output of EC-101 includes four parts: main control output (OUT), ALiliary output1 (AL1), ALiliary output2 (AL2), ALiliary output3 (AL3). The terminal function has multi definitions and it is determined by the function of the output interface mounted. The connection is based on black point symbol;

b) The input of terminals “11” & “12” is 0-5V or 1-5V when delivery if not indicated when ordered. If the exact input is 0-10mA or 4-20mA, may parallel connect a 500ohm or 250ohm precision resistance to input terminals;

c) c) If J3 is selected for main output, that is there are two channel’s alarm, terminal ’13’ & ‘14’ corresponds to the 4th alarm, the indicator corresponds to AL3;



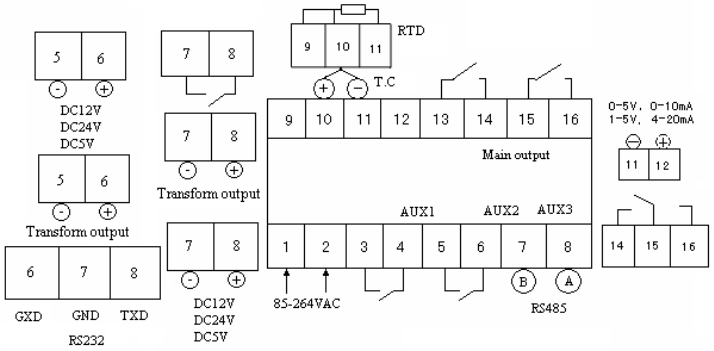
2) 96 X 48(H), 160 X 80(H):

Note:

a) The output of EC-101 includes four parts: main control output (OUT), ALiliary output1 (AL1), ALiliary output2 (AL2), ALiliary output3 (AL3). The terminal function has multi definitions and it is determined by the function of the output interface mounted. The connection is based on black point symbol;

b) The input of terminals “11” & “12” is 0-5V or 1-5V when delivery if not indicated when ordered. If the exact input is 0-10mA or 4-20mA, may parallel connect a 500ohm or 250ohm precision resistance to input terminals;

c) If J3 is selected for main output, that is there are two channel’s alarm, terminal ’13’ & ‘14’ corresponds to the 4th alarm, the indicator corresponds to AL3;

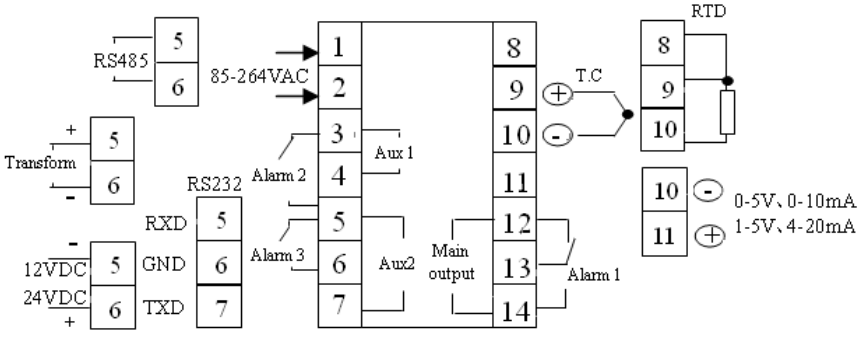


3）72 x 72 (H):

Note:

a) The output of the instruments includes three parts: main control output (OUT), ALiliary output1 (AL1), ALiliary output2 (AL2). The terminal function has multi definitions and it is determined by the function of the output interface mounted. The connection is based on black point symbol;

b) The input of terminals “10” & “11” is 0-5V or 1-5V when delivery if not indicated when ordered. If the exact input is 0-10mA or 4-20mA, may parallel connect a 500ohm or 250ohm precision resistance to input terminals;



4）48 x 48:

Note:

a) The output of the instruments includes two parts: main control output (OUT), ALiliary output1 (AL1). The terminal function has multi definitions and it is determined by the function of the output interface mounted. The connection is based on black point symbol;

b) The input of terminals “10” & “8” is 0-5V or 1-5V when delivery if not indicated when ordered. If the exact input is 0-10mA or 4-20mA, may parallel connect a 500ohm or 250ohm precision resistance to input terminals;

c) There is no linear input option for the instruments when delivery, if the input signal is standard current or voltage, please move the jumper to the other two holes in the main output module (please refer to the diagram);

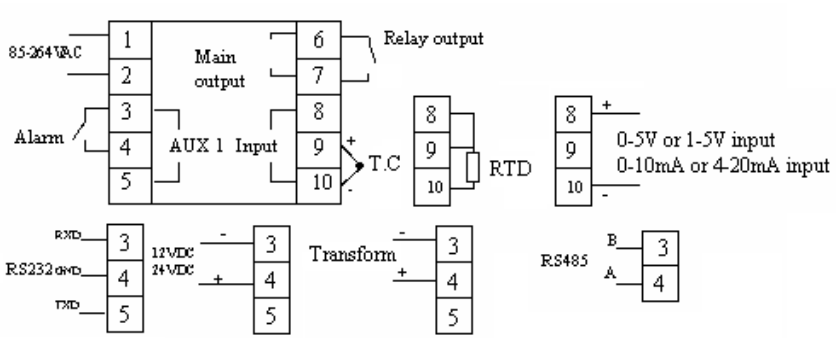
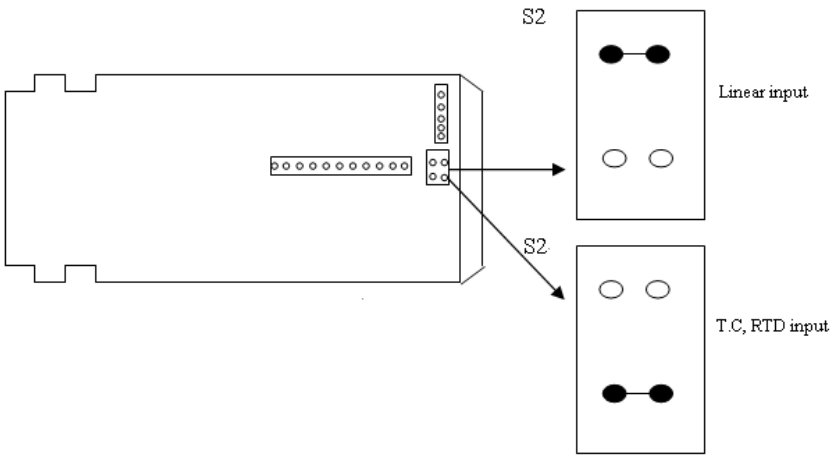


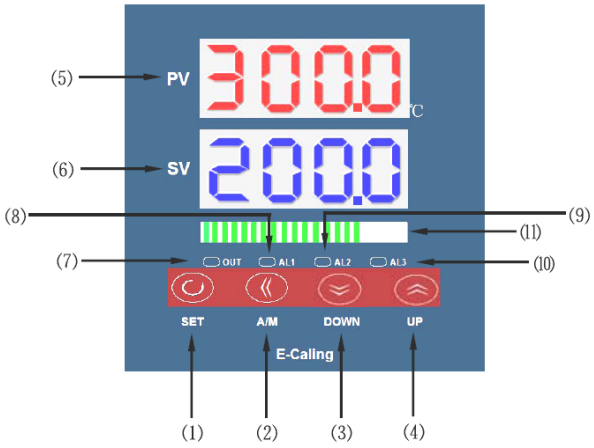
Diagram of G type main board:



Unit 2 Operation instruction

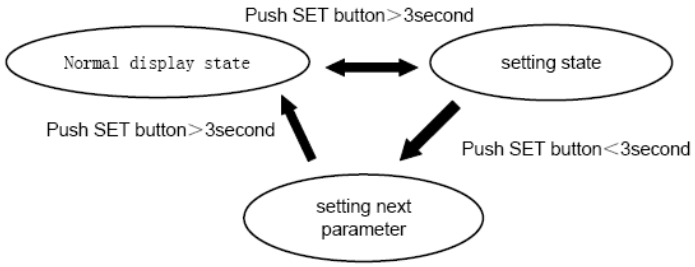
2.1 Panel introduction

Take type A (96×96mm) as example:



(1) （SET）button：

- Keep pressing more than 3 seconds to switch between normal display state and setting state；
- In setting state, press once to save the new set value of parameters and select the next parameter to be set；

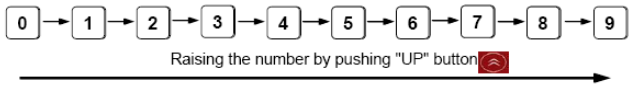


(2) （A/M）button：A：means auto，M:means manual，and moves the cursor toward left

In setting state，used for moving the point toward the left.

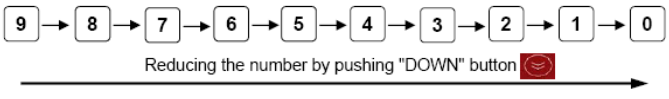
(3) UP button：

In setting state，used for increasing Numbers.



(4) Down button：

In setting state，used for reducing Numbers.



(5)Upper display window(PV)：

- In normal display state, it displays measured value。
- In setting state, it displays the symbol of parameter to be set

(6)Lower display window (SV)：

- In normal display state, it displays the 1st alarm value;
- In setting state, it displays the set value of the selected parameter;

(7) OUT：the first alarm indicator

OUT indicator is on when it meets the condition of the first alarm and the first alarm output terminals 15 & 16 close at the same time; contrarily, out indicator is off and the first alarm output terminals open.

(8) AL1：the second alarm indicator
indicator is on when it meets the condition of the second alarm and the second alarm output terminals 3 & 4 close at the same time; contrarily, AUX1 indicator is off and the second alarm output terminals open.

(9) AL2：the third alarm indicator
indicator is on when it meets the condition of the third alarm and the third alarm output terminals 5 & 6 close at the same time; contrarily, AUX2 indicator is off and the third alarm output terminals open;

(10) AL3：the fourth alarm indicator
indicator is on when it meets the condition of the fourth alarm and the fourth alarm output terminals 7 & 8 or 13 & 14 close at the same time; contrarily, AUX3 indicator is off and the fourth alarm output terminals open.

1) (11) 20 segments pillar-light

It is used to display the measured value in simulation and its corresponding measured value is determined by **LoL** and **HiL**.

2.2 States of the Instrument

Normal state: When the instruments work in the normal state, upper window displays measured value and lower window displays the first alarm value;

Setting state: When the instruments work in parameters setting state, upper window displays the parameters to be set and lower window displays the set value of the parameters.

2.3 Operation instruction

Power on self test

1、Connect the instrument correctly according to the terminal connection diagram on shell: power (terminal 1 & 2), input, output and alarm;
2、Check the connection carefully and make sure it is correct, then turn power on;
3、The instrument enters self test state at once when power on. Upper window (PV) displays measured value; lower window (SV) displays the first alarm value. If there is error, upper window (PV) displays ‘SYS’ and lower window (SV) displays ‘Err’.

2.4 **Parameters setting:**

Brief introduction of Parameter Setting

In the normal display state, keep pressing for 3 seconds, the system will enter parameter setting state.

In setting state, press once to amend the next parameter; keep pressing for 3 seconds to enter normal state.

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2.5 **Parameters table:**

Symbol	Parameter definition	Setting range	Notes
Loc	Parameter modification enable	ON/OFF	ON: enable parameter change; OFF: disable parameter change
HL1	The first alarm mode	ON/OFF	ON: upper limit alarm OFF: lower limit alarm
HL2	The second alarm mode	ON/OFF	ON: upper limit alarm OFF: lower limit alarm
HL3	The third alarm mode	ON/OFF	ON: upper limit alarm OFF: lower limit alarm
HL4	The fourth alarm mode	ON/OFF	ON: upper limit alarm OFF: lower limit alarm
cP	Cold junction compensation	ON/OFF	Cold-junction automatic/ no compensation
Poin	Decimal point determined	--.-/--- --.--/-.----	When -100<display value<1000, the decimal point is at digit of tens', or else at digit of ones.
oSEt	Zeroing coefficient	-99.9-99.9	Display value=measured value + oSEt
LoL	Lower limit of analog display Lower limit of linear input Display value corresponding to lower limit of transform output	-999-9999	Linear input 0mA,4mA,0V and 1V, Display value corresponding to transform output of 0mA or 4mA lower limit of analog display value
HiL	Upper limit of analog display Upper limit of linear input range Display value corresponding to upper limit of transform output	-999-9999	Linear input 10mA,20mA,5V and 10V, Display value corresponding to Transform output of 10mA or 20mA upper limit of analog display value
Hy	Hystersis of alarm	0-25.5	non-sensitive area of alarm
Sn	Input type	0-17	0:K, 1:S, 2:B, 3:T, 4:E, 5:J, 6:Wre, 7:N, 8:Pt100, 9:Cu50, 10:Cu100, 14:0-5V, 16: 4-20mA, 17:0-10mA
FiL	Input filter coefficient	0-100	No filter function when it is 0
oP	Transform output mode	0-10 4-20	0-10mA current output 4-20mA current output

Remark：In the table set range for alarm value：-999-9999

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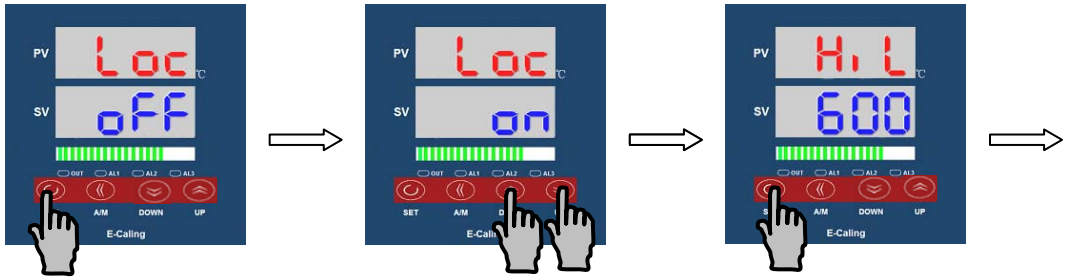
2.5.1 For example introduction：

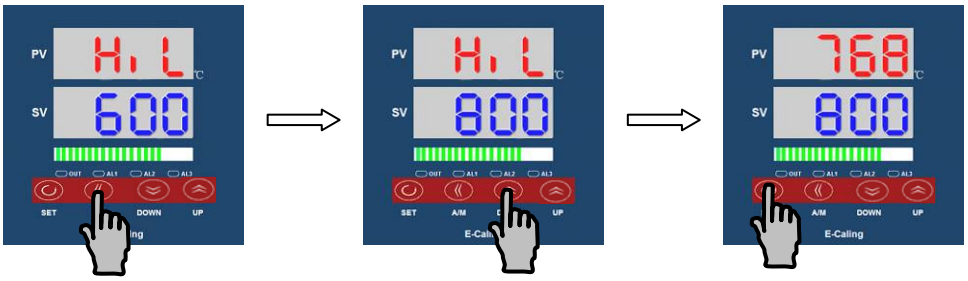
Set parameter **HiL** to be 800，and the original set value is 600



①Keep pressing SET for 3 seconds, the system enters

②Unlock by pressing UP or DOWN

③Press SET several times until the upper



④ Press A/M to move the cursor to hundreds

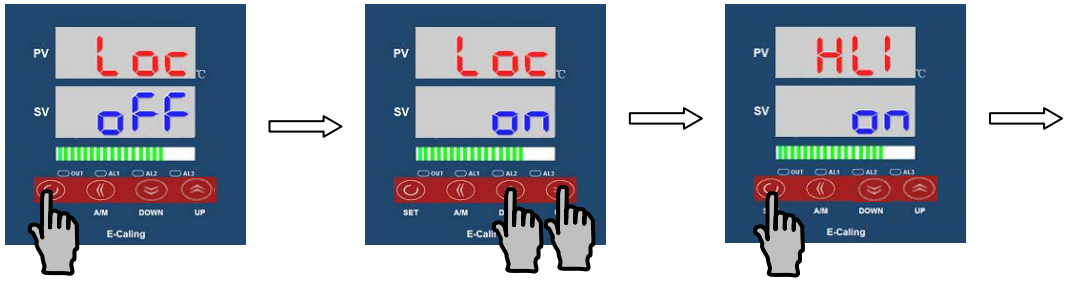
⑤ Press UP to set the hundreds digit to be 8

⑥ After finishing the setting, keep pressing SET for 3 seconds to exit from parameter

2.5.2 Alarm setting：

The instruments have four channels alarm; the alarm may be set to be upper limit and lower limit alarm via setting alarm mode parameter (HL1, HL2, HL3 and HL4). Example: the alarm output is upper limit alarm, user just need to set HL1, HL2, HL3 and HL4 to be 'ON';

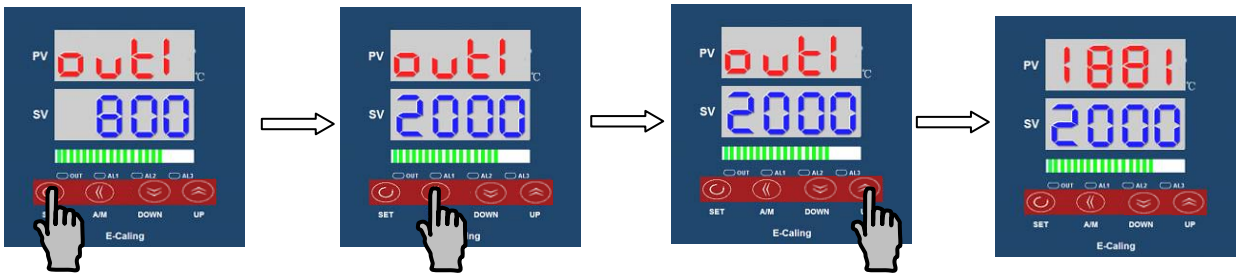
Example: adopts the 1st alarm and set it to be upper limit alarm; when the temperature beyond 2000℃ the 1st alarm output terminals close;



① Keep pressing SET for 3 seconds, the system enters parameter setting state;

② Unlock by pressing UP or DOWN;

③ Press SET several times, until upper window displays **HL1**; press UP button to set it to be 'ON';



④ Press SET to select parameter **OUT1**, the ones

⑤ Press A/M to move the point .

⑤Press UP and DOWN to set **OUT1** to be 2000.

⑥After finishing the Setting, keep

2.5.3 Cold-junction compensation:

When the input is thermocouple, and cold-junction compensation is needed, parameter **cP** should be 'ON'.

Linear input

If the input is standard current or voltage, such as the output of the transmitter of level, pressure and temperature, the lower limit of linear input **LoL** and the upper limit of linear input **HiL** should be set according to the nominal value. For example, the instrument is connected with level transmitter, the output of the transmitter is 4-20mA and the corresponding pressure is 0m-10m, the parameter should be set as follow:

Poin= - - -. –	Or	Poin= - -. –
Sn=16		Sn=16
LoL=0.0		LoL=0.00
HiL=10.0		HiL=10.00

Input Type

For set range of input type parameter **Sn**, please refer to parameter table;

Example: if the input is 4-20mA, then **Sn** should be 16;

Input Type

For set range of input type parameter **Sn**, please refer to parameter table;

Example: if the input is 4-20mA, then **Sn** should be 16;

2.5.4Transform output

The transform output of the instruments can be set to be 0-10mA or 4-20mA freely.

The transform range is determined by parameter LoL and HiL, Example:

The measured value is for temperature, set:

LoL=0

HiL=100

oP=4-20

When measured value is more than or equal to 100℃, the transform output is 20mA;

When measured value is 50℃, the transform output is 12mA.

Note: As to linear current input (0-10mA, 4-20mA) and linear voltage input (0-5V, 1-5V), only one kind can be chosen when ordering. Without specification, the linear voltage input (0-5V, 1-5V) is adopted; if the field input is current, please parallel connect a precision resistor between the input terminals: if the field input is 0-10mA, please parallel connect a resistor of 500ohm, and set **Sn** to be 14; if the field input is 4-20mA, please parallel connect a resistor of 250ohm, and set **Sn** to be 15.

Unit 3 Function introduction

3.1 Alarm

a) When measured value is less than lower limit, the indicator is on and alarm contact close;

b) When measured value is bigger than upper limit, the indicator is on and alarm contact close;

c) Alarm hytersis (Hy)

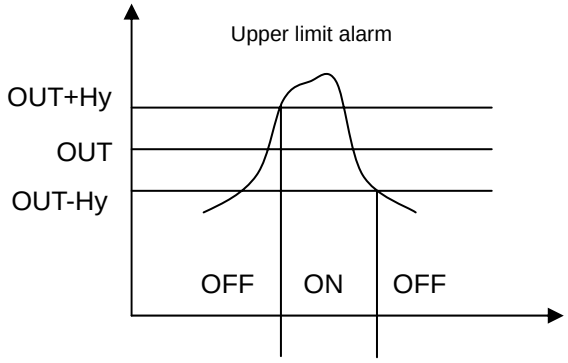


Figure 1

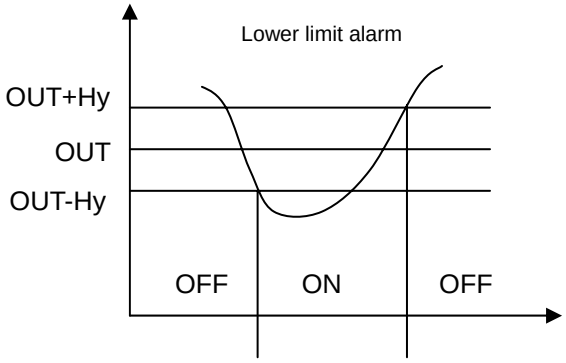


Figure 2

In order to avoid the frequent action of alarm output when the measured value is fluctuating at the critical point of alarm, the parameter of alarm hytersis **Hy** is used.

When measured value increases to OUT1+Hy, upper limit alarm exports; when measured value decreases to OUT1, the alarm does not stop; only when measured value is less than OUT1-Hy, the alarm stops; refer to Figure 1.

When measured value decreases to OUT1-Hy, lower limit alarm exports; when measured value increases to OUT1+Hy, lower limit alarm stops; refer to Figure 2.

3.2 Transform Output

The measured value can be converted to 0-10mA or 4-20mA standard current. The current output form is determined by parameter **oP** and the transform range of measured value is determined by the parameters **LoL** and **HiL**.

1) When the input is linear, the transform output is the conversion output of the input signal. For example, assume the input is 0-10mA (**Sn**=17) and transform output is 4-20mA (**oP**=4-20), when the input is

0mA, the output is 4mA; when the input is 10mA, the output is 20mA.

2) When the input is thermocouple or RTD, the transform output range is determined by **LoL** and **HiL**. For example, if **LoL**=200, **HiL**=800 and **oP**=4-20, when the measured value is 200$^{\circ}C$, the output is 4mA; when the measured value is 800$^{\circ}C$, the output is 20mA.

3.3 Pillar-light simulated display

There are 20 segments pillar-light to display measured value, the display range is determined by **LoL** and **HiL**:

When measured value is less than or equal to **LoL** set value, the pillar-light are all off;

When **LoL** set value<measured value<**HiL** set value, the segments of alighted pillar-light is proportional to the measured value;

When measured value is bigger than or equal to **HiL** set value, t the pillar-light are all on.

3.4 Example

3.4.1 The instrument is used to control liquid level, and when the level is higher than 9m, upper limit alarm exports; when the level is lower than 2m, lower limit alarm export. The liquid level transmitter is of 2-wire 4-20mA output and the corresponding value is 0-10m; the parameters are set as follows:

HL1=oN, LoL=0.0

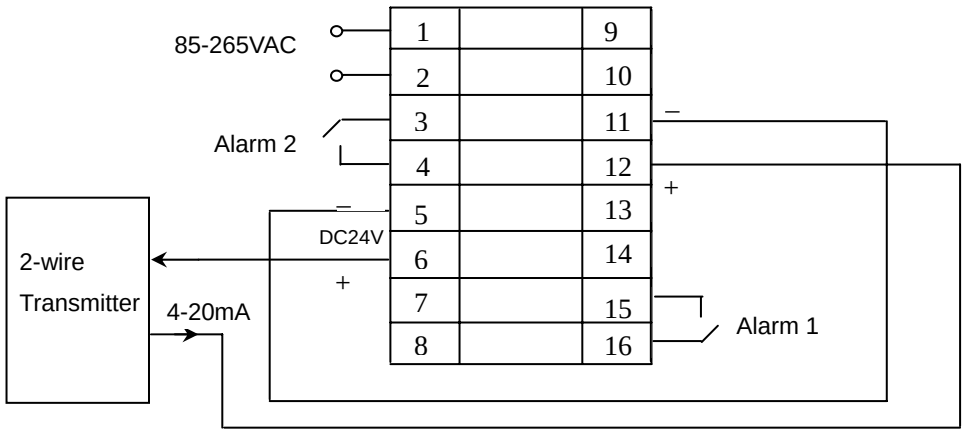
HL2=oFF, HiL=10.0

Poin=---.-, Hy=0.2

OUT1=9.0, Sn=16

OUT2=2.0

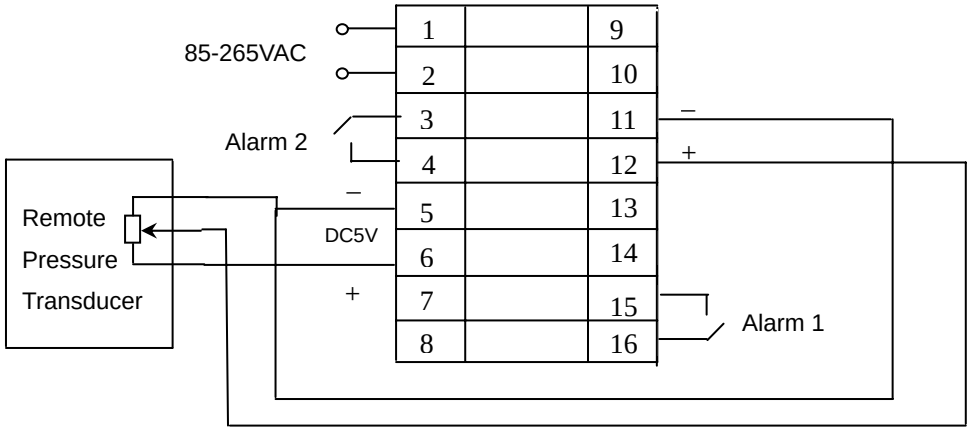
3.4.2 Connection Example



Sn=16

LoL=**** (lower limit of transmitter measuring range)

LiL=**** (upper limit of transmitter measuring range)



Sn=14

LoL=**** (lower limit of transducer measuring range)

LiL=**** (upper limit of transducer measuring range)

Unit 4 Communication protocol

4.1 Communication rules

LU-904M adopts asynchronous serial communication, can be equipped with RS-232C, RS422A or RS485 communication interface, and may communicate with baud rate of 1200-9600. Format of serial data frame is 1 start bit (bit 0), 8 data bit (bit 1-8), 1 addressing bit (bit 9) and 1 stop bit, total 11 bits; the data is hex.

4.2 Answer command format

In each communication instruction, the instrument returns following message at the end:

4FH 4BH (OK) means communication success

or 3FH 3FH (??) means communication fail

4.3 Data format

1) Data format: complement of two bytes.

2) Parameters with specified range.

a) MV: range of current transform output, range: 0 – 200; MV=0 means current transform output is 0mA, and MV=200 means current transform output is 20mA;

b) Status flag: range: 0 - FFH. 8 bits of it respectively represent 8 parameters of on/off; below pleas see the details.

7	6	5	4	3	2	1	0
HL4			cP	HL3	HL2	HL1	Loc

'1' means ON,

'0' means OFF.

c) oP: transform output mode; oP=2 means 0-10mA transform output; oP=3 means 4-20mA transform output;

d) bAud: baud rate, range: 0-3, which means 1200, 2400, 4800 and 9600 respectively;

Hy, Sn, FiL, oP, Addr, bAud and status flag are all parameters of single byte, so they should be filled with '0' in high byte when written.

4.4 Communication instruction

4.4.1 Addressing instruction

When the host computer wants to communicate with some instrument, it should send an addressing instruction first. The addressing instruction is single byte instruction, bit 1-8 is address and bit 9 is '1' (Non-addressing instruction is '0'). The address of the instrument is determined by parameter Addr. The instrument make a cooperation of the address in the addressing instruction and the address of its own, if they are same, the instrument will start to communicate with the host computer. To the instrument in communication, if it receives an addressing instruction in which the address is not the address of its own, it will close the function of communication.

For example, if the Addr of the instrument is 3, when it is addressed, the format is as follows:

0	1	1	0	0	0	0	0	0	1
0	1	2	3	4	5	6	7	8	9

4.4.2 Survey read (E)

Instruction format: 45H

Return value: PV, SV, MV, 4FH 4BH (OK)

The low byte is at front and the high byte is behind, here SV is no meaning;

4.4.3 Read (R)

Instruction format: 52H + parameter code

Return value: parameter value + 4FH 4BH

4.4.4 Write (W)

Instruction format: 57H + parameter code + parameter value

Return value: 4FH 4BH

4.4.5 End instruction (O)

Instruction format: 4FH or addressing instruction which is not for local machine (bit 9 is '1');

None return value.

4.5 Parameter code table

Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter
0	MV	6	OUT2	12	HiL	18	- - - -
1	- - - -	7	OUT3	13	Hy	19	- - - -
2	Status Flag	8	OUT4	14	- - - -	20	oP
3	- - - -	9	oSEt	15	Sn	21	Addr
5	OUT1	11	LoL	16	FiL	22	bAud

The distributed control system is characterized of centralized administration and distributed control, which is composed of Anthone intelligent instrument and superior computer. Control and data collection are done by inferior instrument. The superior computer performs real-time supervisory control of whole process, records and prints the history data. The fault of the superior computer does not affect the inferior instrument and there is no fault diffusion between inferior instruments for the distributed control. Therefore, it reduces the probability of system crash caused by local faults. Now the price of PC is very cheap and there is almost no limit of memory capacity, so it has good cost performance.

Anthone DCS adopts RS485 communication rules when there are multi-set of instruments communicating and the max. Communication distance is 1km. One communication line is allowed to connect with 128 sets of Anthone serial intelligent instruments at most, and the system structure is very simple and convenient.

For more information, please contact with the suppliers.